

WHAT IS CLAIMED IS:

- sub 1. A cut-through path control method at a router device at which multi-path exists, comprising the steps of:
- 5 selecting one router among a plurality of routers that can possibly be a next hop router so as to contribute to a load balancing, according to a whole or a prescribed part of information regarding a state of cut-through path set up in which the router device is involved, at a time of
- 10 setting up a cut-through path in the multi-path; and carries out a prescribed control for setting up the cut-through path with said one router as the next hop router.
- 15 2. The method of claim 1, wherein the selecting step selects said one router according to a number of already set up cut-through paths such that numbers of cut-through paths at said plurality of routers are uniformly distributed among said plurality of routers.
- 20 3. The method of claim 2, wherein the selecting step includes the sub-steps of:
- assigning possible residue values starting from 0 that are obtainable by dividing a given integer by a total
- 25 number of said plurality of routers, respectively to said plurality of routers. one residue value per each router; and
- selecting one of said plurality of routers which is assigned with a residue value obtained by dividing the
- 30 number of already set up cut-through paths by the total number of said plurality of routers as said one router.
4. The method of claim 1, wherein the selecting step selects said one router according to a number of already
- 35 set up cut-through paths such that numbers of cut-through

paths at said plurality of routers are evenly distributed among said plurality of routers according to link rates with respect to said plurality of routers.

Subs
B1

5 5. The method of claim 4, wherein the selecting step includes the sub-steps of:
assigning possible residue values starting from 0 that are obtainable by dividing a given integer by a total of elements constituting an integer ratio indicating or
10 approximating a ratio of the link rates with respect to said plurality of routers, respectively to said plurality of routers, as many residues values as a number proportional to a link rate with respect to each router per each router; and

15 selecting one of said plurality of routers which is assigned with a residue value obtained by dividing the number of already set up cut-through paths by the total of the elements constituting the integer ratio as said one router.

20 6. The method of claim 1, further comprising the steps of:
sending a message for setting up the cut-through path to said one router; and
25 making an information setting necessary for utilizing the cut-through path when the cut-through path is set up.

7. The method of claim 1, further comprising the steps of:
30 sending a message for setting up the cut-through path to said one router when no other already set up cut-through path to said one router exists, and making an information setting necessary for utilizing the cut-through path when the cut-through path is set up; and
35 making another information setting necessary for

merging the cut-through path with an already set up cut-through path to said one router when the already set up cut-through path exists.

5 8. The method of claim 1, wherein the setting up of the cut-through path starts at a timing of receiving a message for setting up the cut-through path from a node device on an upstream side.

10 9. The method of claim 1, further comprising the steps of:

selecting one cut-through path that contributes to the load balancing when a route change is made, among cut-through paths for which the route change at the router

15 device is possible; and

changing a route of said one cut-through path so as to contribute to the load balancing.

sub a²
20 10. A cut-through path control method at a router device at which multi-path exists, comprising the steps of:

selecting one cut-through path that contributes to a load balancing when a route change is made, among cut-through paths for which the route change at the router device is possible; and

25 changing a route of said one cut-through path so as to contribute to the load balancing.

11. The method of claim 10, further comprising the step of:

30 checking a traffic amount to each of a plurality of node devices that are next hop nodes of cut-through paths from the router device at prescribed timings;

wherein the selecting step selects said one cut-through path that satisfies a prescribed condition

35 regarding the traffic amount when a level of imbalance

among traffic amounts to said plurality of node devices exceeds a prescribed tolerable range, said one cut-through path being in a multi-path with one node device with less traffic amount as a next hop node; and

5 the changing step changes the route of said one cut-through path by changing the next hop node of said one cut-through path to another node device with more traffic amount.

10 12. The method of claim 11, wherein the selecting step and the changing step are repeated until the level of imbalance becomes within the prescribed tolerable range or there is no more cut-through path that can be selected by the selecting step.

15 13. The method of claim 11, wherein the selecting step selects one or a plurality of optimal solutions for said one cut-through path.

20 14. A router device at which multi-path exists, comprising:

a processing unit configured to select one router among a plurality of routers that can possibly be a next hop router so as to contribute to a load balancing.

25 according to a whole or a prescribed part of information regarding a state of cut-through path set up in which the router device is involved, at a time of setting up a cut-through path in the multi-path;

30 a control unit configured to carry out a prescribed control for setting up the cut-through path with said one router as the next hop router; and

a transfer unit configured to transfer datagrams using the cut-through path.

35 15. The router device of claim 14, wherein the processing

unit selects said one router according to a number of already set up cut-through paths such that numbers of cut-through paths at said plurality of routers are uniformly distributed among said plurality of routers.

5

16. The router device of claim 14, wherein the processing unit selects said one router according to a number of already set up cut-through paths such that numbers of cut-through paths at said plurality of routers are evenly distributed among said plurality of routers according to link rates with respect to said plurality of routers.

10

17. A router device at which multi-path exists, comprising:

15 a processing unit configured to select one cut-through path that contributes to a load balancing when a route change is made, among cut-through paths for which the route change at the router device is possible;

20 a control unit configured to change a route of said one cut-through path so as to contribute to the load balancing; and

a transfer unit configured to transfer datagrams using the cut-through path.

25 18. The router device of claim 17, further comprising:

a measurement unit configured to check a traffic amount to each of a plurality of node devices that are next hop nodes of cut-through paths from the router device at prescribed timings;

30 wherein the processing unit selects said one cut-through path that satisfies a prescribed condition regarding the traffic amount when a level of imbalance among traffic amounts to said plurality of node devices exceeds a prescribed tolerable range, said one cut-through path being in a multi-path with one node device with less

35

traffic amount as a next hop node; and

the control unit changes the route of said one cut-through path by changing the next hop node of said one cut-through path to another node device with more traffic

5 amount.

19. A computer usable medium having computer readable program code means embodied therein for causing a computer to function as a router device at which multi-path exists, the computer readable program code means includes:

first computer readable program code means for causing said computer to select one router among a plurality of routers that can possibly be a next hop router so as to contribute to a load balancing, according to a whole or a prescribed part of information regarding a state of cut-through path set up in which the router device is involved, at a time of setting up a cut-through path in the multi-path;

second computer readable program code means for causing said computer to carry out a prescribed control for setting up the cut-through path with said one router as the next hop router; and

third computer readable program code means for causing said computer to transfer datagrams using the cut-through path.

20. A computer usable medium having computer readable program code means embodied therein for causing a computer to function as a router device at which multi-path exists, the computer readable program code means includes:

first computer readable program code means for causing said computer to select one cut-through path that contributes to a load balancing when a route change is made, among cut-through paths for which the route change at the router device is possible;

second computer readable program code means for causing said computer to change a route of said one cut-through path so as to contribute to the load balancing: and

third computer readable program code means for causing
5 said computer to transfer datagrams using the cut-through path.

add Q3

10

15

20

25

30

35

-44-